

Abstract

One embodiment of the present invention is a fuel cell suitable for use downhole in an oil and gas well includes a fuel vessel that providing a source of fuel and an oxidant vessel providing a source of oxidant. A reaction zone comprises at least one cathode, at least one anode, and an electrolyte between each anode and cathode. A closed water vessel is connected to the reaction zone by at least one capillary flow path. The fuel cell also comprises a fuel conduit that connects the fuel vessel and the reaction zone. This fuel conduit comprises a fuel pressure control apparatus adapted to maintain a static pressure of fuel in the reaction zone. The fuel cell further comprises an oxidant conduit that connects the oxidant vessel and the reaction zone, and includes an oxidant pressure control apparatus adapted to maintain a static pressure of oxidant in the reaction zone. In addition, the fuel cell comprises electrical conductors connected to the anode and cathode and adapted to conduct electricity to an external device. In this fuel cell, there is no need for fuel, oxidant, or water to flow in a closed loop through the reaction zone.